SQL Server Database Engineering

Day 1 – Advanced SQL Design & Development

Module 1: Database Design & SQL Development Foundations

- SQL Server Architecture Overview
- Databases, Schemas, Objects
- Data Types
- Advanced Table Design
- Constraints (Primary Key, Foreign Key, Default, Check)

Lab:

- Create training database
- Design relational tables
- Implement constraints

Module 2: Views and Query Design

- Views
- Updatable Views
- View Best Practices
- CTE
- Recursive CTE

Lab:

- Create reporting views
- Build recursive hierarchy using CTE

Module 3: SQL Server Functions

- Built-in Functions
- User Defined Functions
- Scalar Functions
- Inline TVF
- Multi Statement TVF

Lab:

- Create reusable business functions
- Build reporting TVFs

Module 4: Stored Procedures & Error Handling

- Stored Procedures
- Input/Output Parameters
- Dynamic SQL and SQL Injection Prevention
- Controlling Transactions
- TRY–CATCH
- THROW vs RAISERROR

Lab:

- Build CRUD procedures
- Implement transaction and error logging

Module 5: Triggers

- DML Triggers
- AFTER Trigger
- INSTEAD OF Trigger
- Trigger Best Practices

Lab:

- Implement audit trigger
- Control update operations

Day 2 – Security & Data Protection

Module 6: SQL Server Security Architecture

- Authentication vs Authorization
- Login Creation and Management
- Database Users
- Server-Level Security

Lab:

- Configure SQL and Windows authentication

Module 7: Permissions and Roles

- Server Roles
- Database Roles
- Custom Roles
- GRANT, DENY, REVOKE

Lab:

- Implement role-based access

Module 8: Row Level Security (RLS)

- Security Policies
- Predicate Functions
- Data Isolation

Lab:

- Implement row-level access control

Module 9: Dynamic Data Masking & Always Encrypted

- Dynamic Data Masking
- Always Encrypted
- Encryption Architecture
- Key Management

Lab:

- Secure sensitive business data

Module 10: SQL Audit

- SQL Audit Architecture
- Server Audit
- Database Audit
- Audit Log Analysis

Lab:

- Configure and review audit events

Day 3 – Administration & Database Operations

Module 11: Backup Fundamentals

- Recovery Models
- Full Backup
- Differential Backup
- Transaction Log Backup

Lab:

- Configure backup strategy

Module 12: Recovery Operations

- Restore Database

- Point-in-Time Recovery
- Tail Log Backup
- Recovery Scenarios

Lab:

- Execute complete recovery workflow

Module 13: Advanced Table Optimization

- Table Partitioning
- Partition Functions
- Partition Schemes
- Data Compression
- Row Compression
- Page Compression

Lab:

- Implement partitioning and compression

Module 14: SQL Server Agent Jobs

- Job Creation
- Scheduling
- Alerts
- Maintenance Automation

Lab:

- Automate backup and maintenance tasks

Day 4 – Performance Tuning

Module 15: Indexing

- Clustered Index
- Nonclustered Index
- Included Columns
- Filtered Index

Lab:

- Optimize queries using indexes

Module 16: Execution Plans & Query Optimization

- Estimated vs Actual Execution Plans

- Statistics
- Query Optimization

Lab:

- Tune slow-running queries

Module 17: Query Store

- Enable Query Store
- Plan Tracking
- Force Plan

Lab:

- Compare and stabilize query plans

Day 5 – Monitoring & Troubleshooting

Module 18: Locking & Concurrency

- Lock Types
- Blocking
- Deadlocks
- Isolation Levels

Lab:

- Troubleshoot concurrency issues

Module 19: Extended Events

- Event Sessions
- Performance Monitoring
- Deadlock Analysis

Lab:

- Capture and analyze SQL activity

Module 20: Monitoring & Troubleshooting Framework

- Performance Baseline
- Resource Monitoring
- Troubleshooting Methodology

Lab:

- Identify and resolve bottlenecks